REMARKS

Reconsideration and withdrawal of the objections and rejections set forth in the above-mentioned Official Action in view of the foregoing amendments and the following remarks are respectfully requested.

Claims 1-33 remain pending in the application, with Claims 1, 12 and 23 being independent. Claims 1, 3-6, 8-12, 14-16, 19-24, 27-29, 32 and 33 have been amended herein.

Applicants request that the Examiner consider the documents cited in the Supplemental Information Disclosure Statement filed August 28, 2001, and indicate such consideration by initialing and returning the Information Disclosure Citation form (Form PTO-1449) provided therewith.

The Examiner requested that Figures 16 and 17 be designated as --PRIOR ART--. However, as described in Applicants' specification at page 44, line 18 through page 45, line 15, the content of these figures was "unknown." Applicants submit that Figures 16 and 17 were not publicly known prior to the filing of the present application. Accordingly, Figures 16 and 17 need not be designated as --PRIOR ART--. Favorable consideration is requested.

Claims ~~18~~ 8 and 19 were objected to for minor errors. Rather than amending these claims in the manner suggested by the Examiner, these claims have been revised to even more accurately reflect Applicants' disclosure. Favorable consideration and withdrawal of the objection to these claims are requested.

Claims 4, 5, 9, 10, 12-23 and 28-33 were rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite. Without conceding the propriety of the rejection, Applicants have reworded the language questioned by the Examiner to advance prosecution. Reconsideration and withdrawal of the § 112 rejection are requested.

Claims 1, 3, 7, 11, 12, 14, 18, 22-27 and 29-32 were rejected under 35 U.S.C. § 102 as being anticipated by U.S. Patent No. 5,497,174 (Stephany, et al.). Claims 2, 6, 13 and 17 were rejected under 35 U.S.C. § 103 as being unpatentable over Stephany, et al. in view of U.S. Patent No. 6,183,056 (Corrigan, et al.). Claims 4, 5, 10, 15, 16 and 21 were rejected under 35 U.S.C. § 103 as being unpatentable over Stephany, et al. in view of European Patent Document No. 0 626 266 (Nagoshi, et al.). Claims 8 and 19 were rejected under 35 U.S.C. § 103 as being unpatentable over Stephany, et al. in view of U.S. Patent No. 5,223,853 (Wysocki, et al.). Claims 9 and 20 were rejected under 35 U.S.C. § 103 as being unpatentable over Stephany, et al. in view of U.S. Patent No. 6,116,717 (Anderson, et al.). Claims 28 and 33 were rejected under 35 U.S.C. § 103 as being unpatentable over Stephany, et al. in view of U.S. Patent No. 5,610,638 (Courtney). These rejections are respectfully traversed.

Independent Claim 1 is directed to a printing apparatus for performing printing by using a printhead having a plurality of printing elements. Independent Claim 12 is directed to a method of controlling such a printing apparatus and independent Claim 23 is directed to a computer-readable memory storing program codes of control of such a printing apparatus. Each independent claim recites means for, steps of or program codes of discriminating the number of simultaneously driven printing elements of the plurality of

printing elements when printing data is printed, determining a fundamental pulse width on the basis of driving conditions according to a condition of the printhead, and controlling a driving pulse to be applied to the printing elements used in the printing of the printing data, on the basis of the determined fundamental pulse width and the discriminated number of simultaneously driven printing elements.

With the above arrangement and method, an optimal fundamental pulse width can be determined on the basis of driving conditions according to conditions of the printhead such as unique characteristics of the printhead. These can include, for example, the printhead temperature. After determining the fundamental pulse width on the basis of driving conditions according to conditions of the printhead, pulse width modulation of the driving pulse need only be performed on the basis of the fundamental pulse width and the number of the simultaneously driven printing elements. Accordingly, pulse width modulation can be performed quickly.

Stephany, et al. relates to an ink jet printer that compensates for voltage drop in the pulse signals applied to a plurality of heater elements. According to Applicants, the driving pulse width is adjusted based on the number of simultaneously driven printing elements. However, Applicants submit that Stephany, et al. does not disclose or suggest controlling the driving pulse based on a fundamental pulse width determined on the basis of driving conditions according to a condition of the printhead and the number of simultaneously driven printing elements, as is recited in independent Claims 1, 12 and 23. Accordingly, Stephany, et al. fails to disclose or suggest important features of the present invention recited in the independent claims.

Corrigan, et al., Nagoshi, et al., Wysocki, et al., Anderson, et al. and Courtney have also been reviewed, but are not believed to remedy the deficiencies of Stephany, et al. noted above with respect to the independent claims.

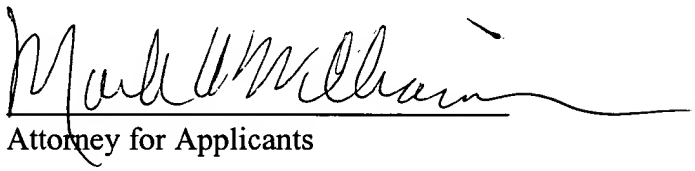
Thus, independent Claims 1, 12 and 23 are believed to be patentable over the citations of record. Reconsideration and withdrawal of the §§ 102 and 103 rejections are respectfully requested.

For the foregoing reasons, Applicants respectfully submits that the present invention is patentably defined by independent Claims 1, 12 and 23. Dependent Claims 2-11, 13-22 and 24-33 are also allowable, in their own right, for defining features of the present invention in addition to those recited in their respective independent claims. Individual consideration of the dependent claims is requested.

Applicants submit that the present application is in condition for allowance. Favorable reconsideration, withdrawal of the objections and rejections set forth in the above-noted Office Action, and an early Notice of Allowance are requested.

Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE TO CLAIMS

1. (Amended) A printing apparatus for performing printing by using a printhead having a plurality of printing elements, comprising:

discriminating means for discriminating the number of simultaneously driven printing elements of said plurality of printing elements when printing data is printed; [and]

determining means for determining a fundamental pulse width on the basis of driving conditions according to a condition of the printhead; and

control means for controlling a driving pulse to be applied to printing elements used in the printing of the printing data, on the basis of [a] the fundamental pulse width [changeably] determined [on the basis of driving conditions of said printhead] by said determining means and the number of simultaneously driven printing elements discriminated by said discriminating means.

3. (Amended) The apparatus according to claim 1, [wherein said control means comprises] further comprising:

storage means for storing a first management table for managing the correspondence of the driving conditions with the fundamental pulse width, and a second management table for managing the correspondence of the fundamental pulse width with a change amount of the fundamental pulse width based on the number of simultaneously driven printing elements; and

[first determining means for determining a fundamental pulse width corresponding to the driving conditions by looking up the first management table; and]

second determining means for determining a change amount of the fundamental pulse width, which corresponds to the number of simultaneously driven printing elements, by [looking up] using the second management table, [and]

wherein said first determining means determines the fundamental pulse width using the first management table, and

said control means changes the fundamental pulse width determined by said first determining means by the change amount determined by said second determining means to generate a driving pulse to be applied to printing elements used in the printing of the printing data.

4. (Amended) The apparatus according to claim 1, wherein said control means defines the fundamental pulse width by either one of leading and trailing edges of a pulse signal on the basis of the driving conditions, and controls a driving pulse width of a driving pulse to be applied to printing elements by the other of the leading and trailing edges of the pulse signal, on the basis of the number of simultaneously driven printing elements.

5. (Amended) The apparatus according to claim 4, [wherein said control means comprises] further comprising storage means for storing a first management table for managing the correspondence of the driving conditions with the fundamental

pulse width, a second management table for managing the correspondence of the fundamental pulse width with a change amount of the fundamental pulse width based on the number of simultaneously driven printing elements, and a third management table for managing the correspondence of rise time and fall time of the [heat] pulse signal, the driving conditions, and the fundamental pulse width, and

said control means controls a pulse width of the driving pulse corresponding to the number of simultaneously driven printing elements and the driving conditions by [looking up] using the third management table.

6. (Amended) The apparatus according to claim 1, [wherein said printing apparatus comprises] further comprising a plurality of printheads, and

if power lines for supplying power to said printheads are independent of each other, said control means executes the control for each power line.

8. (Amended) The apparatus according to claim 1, wherein said control means, [makes a change amount for the driving pulse, which said control means generates by changing a pulse width of the fundamental pulse] when the number of simultaneously driven printing elements is not more than a predetermined value, sets a pulse width of the driving pulse larger than a [change amount for the driving pulse, which said control means generates by changing a] pulse width calculated from the fundamental pulse width on the basis of the number of simultaneously driven printing elements [of the

fundamental pulse when the number of simultaneously driven printing elements is less than the predetermined value].

9. (Amended) The apparatus according to claim 1, wherein if the number of simultaneously driven printing elements for use in predischarge [of] for recovering said printhead is limited, said control means makes a pulse width of a driving pulse to be applied to printing elements used in the predischarge larger than a pulse width of a driving pulse to be applied to printing elements for use in printing which uses printing elements not less than the number of simultaneously driven printing elements.

10. (Amended) The apparatus-according to claim 1, wherein when predischarge [of] for recovering said printhead is to be performed, said control means applies a driving pulse having a predetermined width to printing elements used in the predischarge.

11. (Amended) The apparatus according to claim 1, wherein [said] each printing element [is] comprises an ink discharge unit comprising an electrothermal transducer for discharging ink by generating a bubble in the ink by heat and a discharge orifice.

12. (Amended) A method of controlling a printing apparatus for performing printing by using a printhead having a plurality of printing elements, comprising:

[the] a discrimination step of discriminating the number of simultaneously driven printing elements of said plurality of printing elements when printing data is printed; [and]

a determination step of determining a fundamental pulse width on the basis of driving conditions according to a condition of the printhead; and

[the] a control step of controlling a driving pulse to be applied to printing elements used in the printing of the printing data, on the basis of [a] the fundamental pulse width [changeably] determined [on the basis of driving conditions of said printhead] in said determination step and the number of simultaneously driven printing elements discriminated in the discrimination step.

14. (Amended) The method according to claim 12, [wherein the control step comprises] further comprising:

[the] a storage step of storing a first management table for managing the correspondence of the driving conditions with the fundamental pulse width, and a second management table for managing the correspondence of the fundamental pulse width with a change amount of the fundamental pulse width based on the number of simultaneously driven printing elements; and

[the first determination step of determining a fundamental pulse width corresponding to the driving conditions by looking up the first management table; and]

[the] a second determination step of determining a change amount of the fundamental pulse, which corresponds to the number of simultaneously driven printing elements, by [looking up] using the second management table, [and]

wherein the first determination step determines the fundamental pulse width using the first management table, and

the control step comprises changing the fundamental pulse width determined in the first determination step by the change amount determined in the second determination step to generate a driving pulse to be applied to printing elements used in the printing of the printing data.

15. (Amended) The method according to claim 12, wherein[,] the control step comprises defining the fundamental pulse width by either one of leading and trailing edges of a pulse signal on the basis of the driving conditions, and controlling a driving pulse width of a driving pulse to be applied to printing elements by the other of the leading and trailing edges at the pulse signal, on the basis of the number of simultaneously driven printing elements.

16. (Amended) The method according to claim 15, [wherein the control step comprises the] further comprising a storage step of storing a first management table for managing the correspondence of the driving conditions with the fundamental pulse

width, a second management table for managing the correspondence of the fundamental pulse width with a change amount of the fundamental pulse width based on the number of simultaneously driven printing elements, and a third management table for managing the correspondence of rise time and fall time of the [heat] pulse signal, the driving conditions, and the fundamental pulse width, and

said control step comprises controlling a pulse width of the driving pulse corresponding to the number of simultaneously driven printing elements and the driving conditions by [looking up] using the third management table.

19. (Amended) The method according to claim 12, wherein the control step, [comprises making a change amount for the driving pulse, which the control step generates by changing a pulse width of the fundamental pulse] when the number of simultaneously driven printing elements is not more than a predetermined value, sets a pulse width of the driving pulse larger than a [change amount for the driving pulse, which the control step generates by changing a] pulse width calculated from the fundamental pulse width on the basis of the number of simultaneously driven printing elements [of the fundamental pulse when the number of simultaneously driven printing elements is less than the predetermined value].

20. (Amended) The method according to claim 12, wherein if the number of simultaneously driven printing elements for use in predischarge [of] for recovering said printhead is limited, the control step comprises making a pulse width of a

driving pulse to be applied to printing elements used in the predischarge larger than a pulse width of a driving pulse to be applied to printing elements for use in printing which uses printing elements not less than the number of simultaneously driven printing elements.

21. (Amended) The method according to claim 12, wherein when predischarge [of] for recovering said printhead is to be performed, the control step comprises applying a driving pulse having a predetermined width to printing elements used in the predischarge.

22. (Amended) The method according to claim 12, wherein [said] each printing element [is] comprises an ink discharge unit comprising an electrothermal transducer for discharging ink by generating a bubble in the ink by heat and a discharge orifice.

23. (Amended) A computer-readable memory storing program codes of control of a printing apparatus for performing printing by using a printhead having a plurality of printing elements, comprising:

a program code of [the] a discrimination step of discriminating the number of simultaneously driven printing elements of said plurality of printing elements when printing data is printed; [and]

a program code of a determination step of determining a fundamental pulse width on the basis of driving conditions according to a condition of the printhead; and

a program code of [the] a control step of controlling a driving pulse to be applied to printing elements used in the printing of the printing data, on the basis of [a] the fundamental pulse width [changeably] determined [on the basis of driving conditions of said printhead] in said determination step and the number of simultaneously driven printing elements discriminated in the discrimination step.

24. (Amended) The apparatus according to claim 1, wherein the fundamental pulse width is [a fundamental pulse width] selected and determined from a plurality of fundamental pulse widths.

27. (Amended) The apparatus according to claim 26, [characterized by] further comprising [a fourth] another management table representing a relationship between the change in fundamental pulse width and the index value, the [fourth] other management table being prepared for each printing mode.

28. (Amended) The apparatus according to claim 27, wherein one of the printing [mode] modes is a mode for performing printing complementarily in accordance with a printing pass count.

29. (Amended) The method [for controlling a printing apparatus] according to claim 12, wherein the fundamental pulse width is [a fundamental pulse width] selected and determined from a plurality of fundamental pulse widths.

32. (Amended) The method according to claim [30] 31, [characterized by] further comprising [a fourth] another management table representing a relationship between the change in fundamental pulse width and the index value, the [fourth] other management table being prepared for each printing mode.

33. (Amended) The method according to claim 32, wherein one of the printing [mode] modes is a mode for performing printing complementarily in accordance with a printing pass count.

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